

AMSAT Youth Initiative

AMSAT Youth Initiative

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FOR PARENTS
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FOR TEACHERS
FOR YOUTH GROUP LEADERS

*Where Satellites in Space
Help Us Improve Life Here on Earth!*

ABOUT TOPICS RESOURCES

Satellites Provide Information Needed to Control Climate Change

Satellites have continuously observed the Earth over the past five decades to the present day. This information helps scientists to chart the evolution for the key components of the climate, better understand Earth system processes, predict future change and drive international action.

This course is designed for students grade 8-12 although many other young adults might find themselves right at home with this material. Students will experience the many exciting facets of learning in this course:

- Online presentations
- Suggested reading and viewing
- Online quizzes for earning certificates
- Laboratory exercises using
 - Online satellite radio receivers
 - Telemetry decoding software
 - Online satellite simulators sending climate change measurements.




Course Outline

- Why Should You Care about Climate Change?
- What Do You Need to Know?
 - Weather
 - Climate
 - The Greenhouse Effect
- What Are the Problems?
 - Gases
 - Particulates
 - Changes in surface reflectivity and absorption
- Effects
- How Do Satellites Measure and Track Problems?
- Sensors
- Types of Satellites
 - Low Earth Orbit
 - Geostationary
- What Can Be Done?



An Introduction to

Satellite Meteorology

Presented by

BuzzSat[®]

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Enter

Basic Properties of the Atmosphere

Start

55 Slides

Weather Basics

Start

34 Slides

Meteorology

Start

57 Slides

Forecasting

Start

67 Slides

Satellite Forecasting

Start

87 Slides

Restart Course

Return

Exit

By the end of this chapter should able to:

- Explain the relationship between air pressure and altitude and the different methods used to measure air pressure.
- Explain how temperature, kinetic energy and particle speed are related.
- Identify the three temperature scales.
- Model a vertical profile of the layers of Earth's atmosphere and how the temperature changes with altitude.
- Define absolute humidity, relative humidity and dewpoint.
- Explain the three ways that heat is transferred through the atmosphere.
- Define evaporation, condensation and precipitation.
- Explain the types of pressure systems and the weather impact.
- Define isobars.
- Explain why the wind blows and pressure gradients.
- Define the Coriolis Force and its impact of global air circulation patterns.

BEGIN!



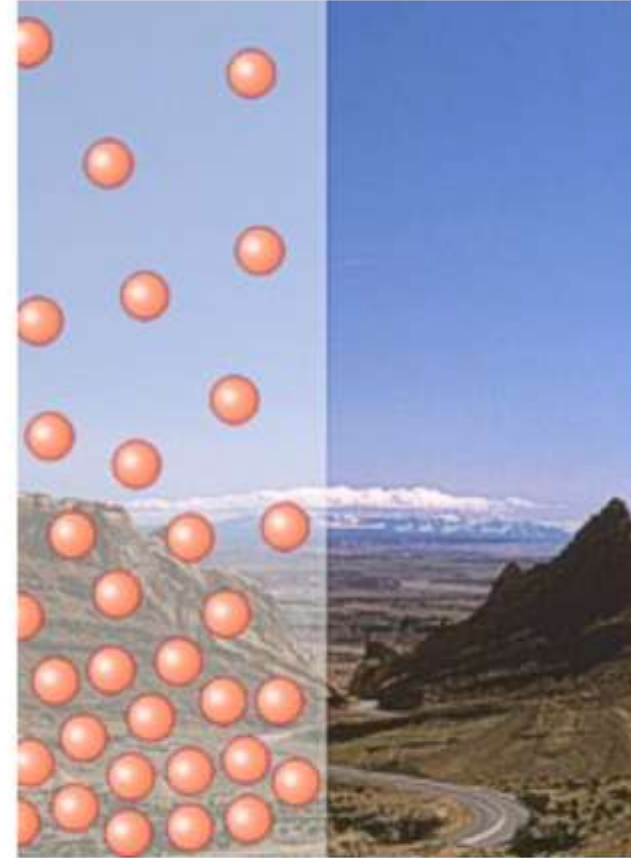
Pressure

Atmospheric pressure is the force exerted by air on a unit area. It can be thought of simply as the weight of the air above a given point. Simply, the fewer molecules above you, the lower the pressure exerted on you and vice versa (more molecules above = higher pressure).

Air pressure is caused by the weight of the molecules in the atmosphere pushing down.

TRUE

FALSE





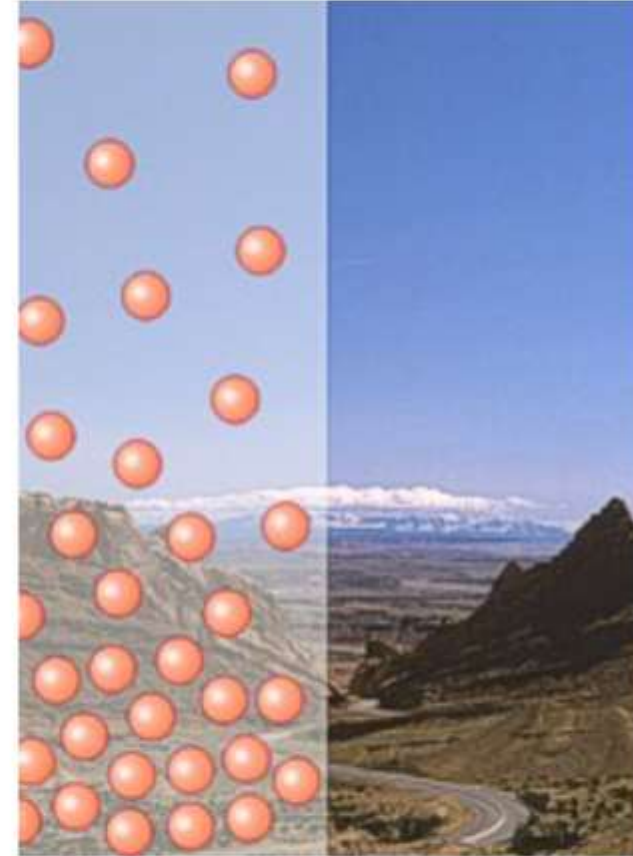
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TRUE

FALSE



Correct!

NEXT

Measuring Air Pressure

In the United States, pressure is commonly expressed in millibars (mb) or inches of mercury (Hg).

Meteorologists use millibars (the unit shown on weather maps and the barometer pictured here), while aviation and television weather reports use inches of mercury.

Atmospheric pressure is measured with a barometer, which is why it is sometimes called barometric pressure. The average sea level pressure is 1013.25 mb or 29.92 Hg.



What is the approximate barometer reading?

Hint: Read outermost numbers where the black indicator is pointing!

765 millibars

761 millibars

1020 millibars

None of the above

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Incorrect. Try again.

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Correct!

NEXT

Polar Orbiting Satellites

There are two basic types of satellites.

The first are polar-orbiting satellites.

They revolve around the Earth at relatively low altitudes, approximately 500 miles.

They pass over the polar regions as Earth rotates underneath.



Click on the solar panels on the NOAA Polar Orbiting Satellite.

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Click on the solar panels on the NOAA Polar Orbiting Satellite.

Correct!

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Restart Course

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Exit

- An Introduction to Satellites Meteorology
 - Satellites and Climate Change
 - Satellites and Pollution Control
 - Satellites Protecting Wildlife and Natural Resources
 - Satellites Detecting and Fighting Wildfires
 - Satellites and Agriculture
 - Navigation Satellites (Terrestrial)
 - Navigation and Tracking Ships and Airplanes
 - Satellites and Home Entertainment
 - Satellites and Command and Control (Military)
 - Satellites and Rescue Missions
 - Space Exploration
- Satellite Telemetry and Management
- Amateur Radio Satellites

Temperature and the Layers of the Atmosphere

Air temperature may also stay the same with increasing height.

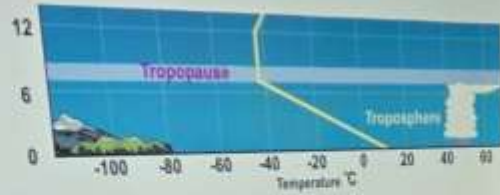
This is called an isothermal layer. At about the altitude where jet aircraft fly (~30,000 ft), the air temperature becomes isothermal.

The boundary separating the troposphere from the stratosphere is called the tropopause.

Air temperature may stay the same with increasing height.

True

False



Satellite Meteorology / Satellite Forecasting

Satellite Forecasting

The use of satellites for the purpose, information exchange and the transmission of data back to Earth depends upon the latest forecast technology.



What are all the data technology used for? (2010-2015)

Table

Troposphere

Tropopause

Troposphere



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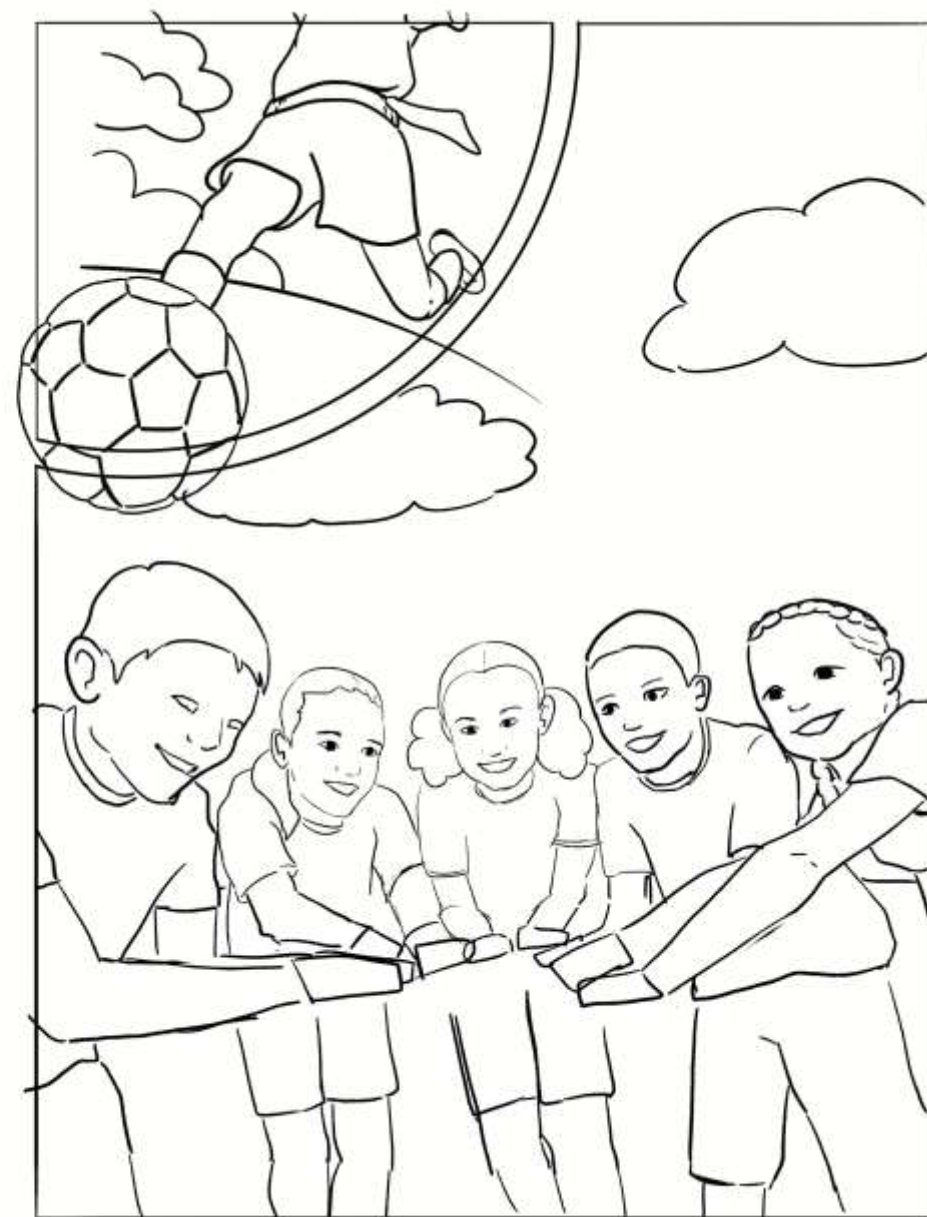
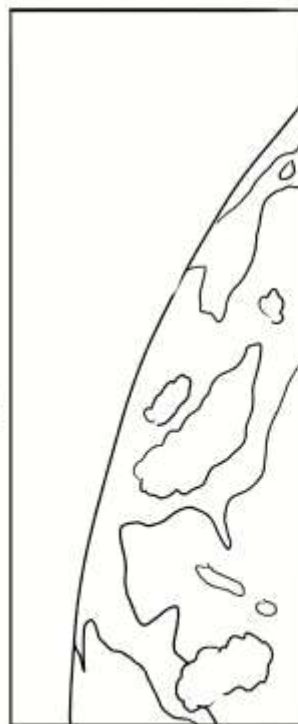
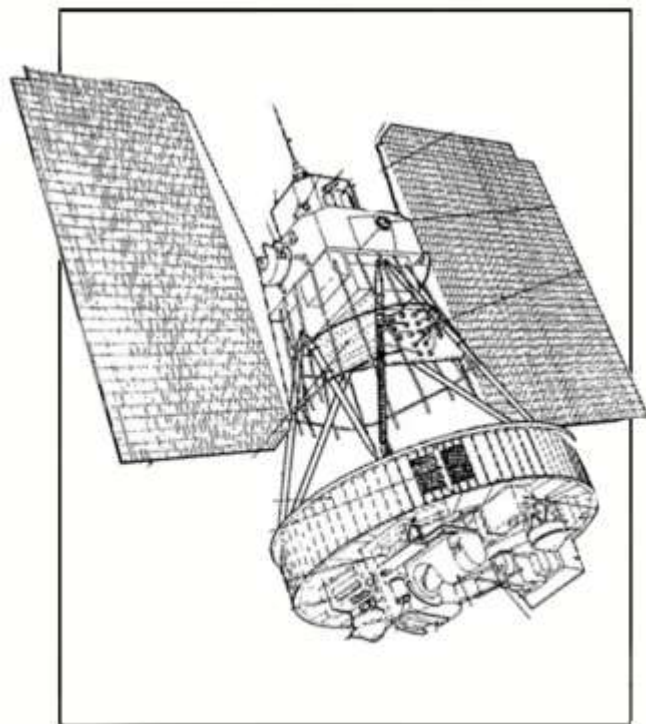
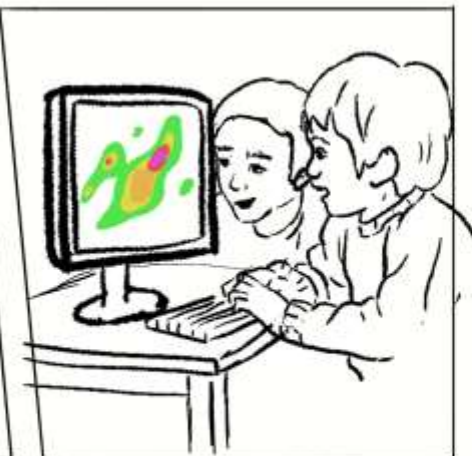
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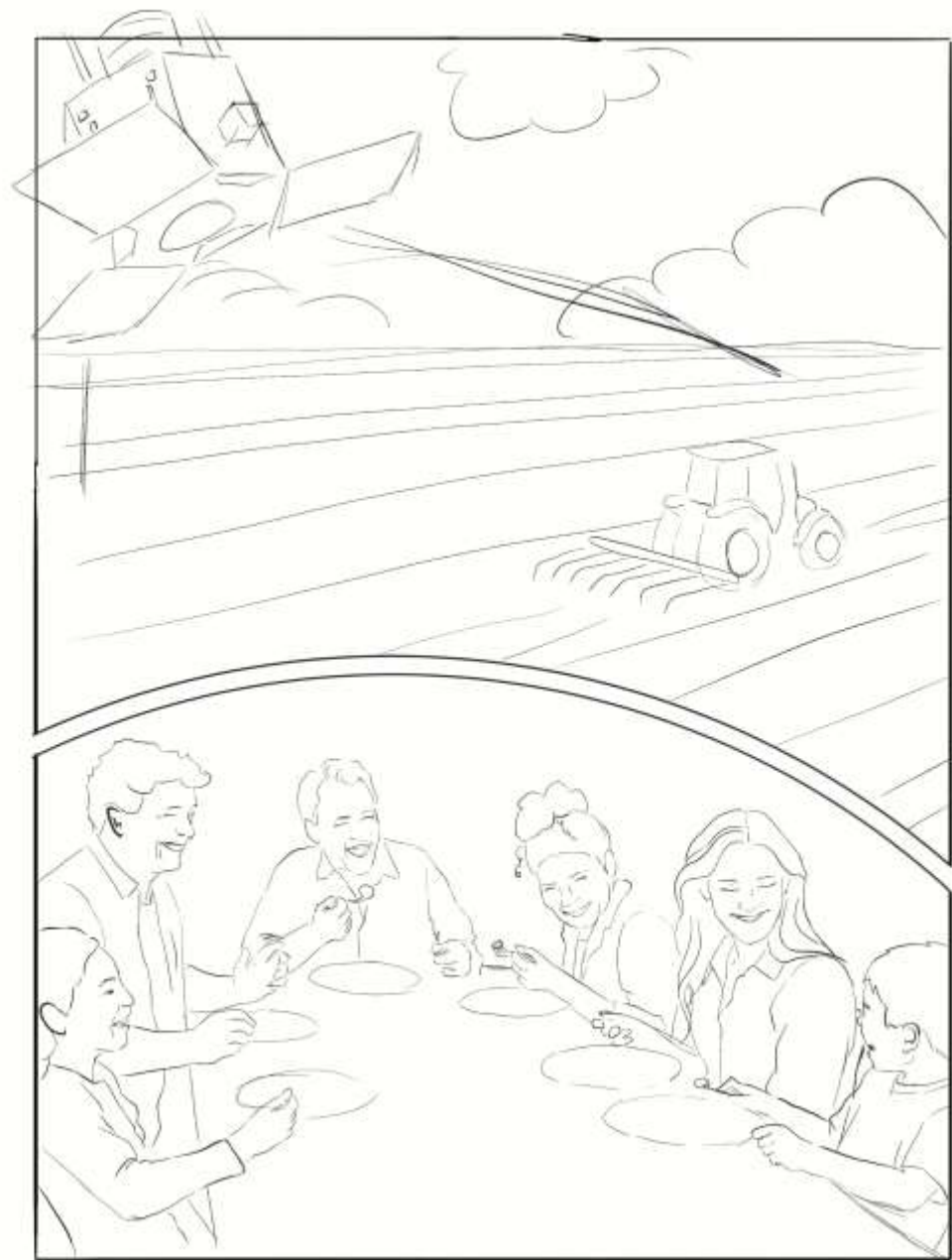
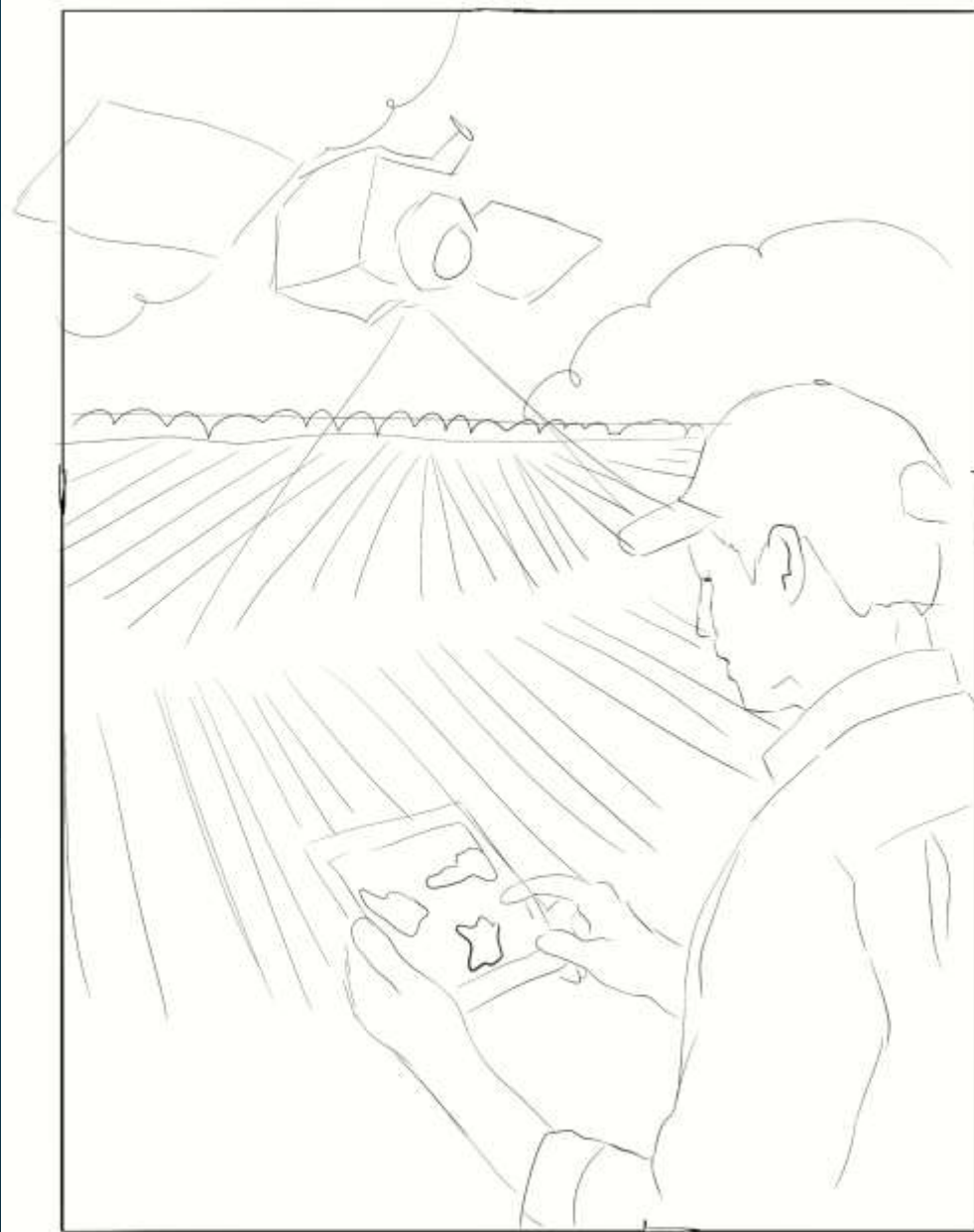
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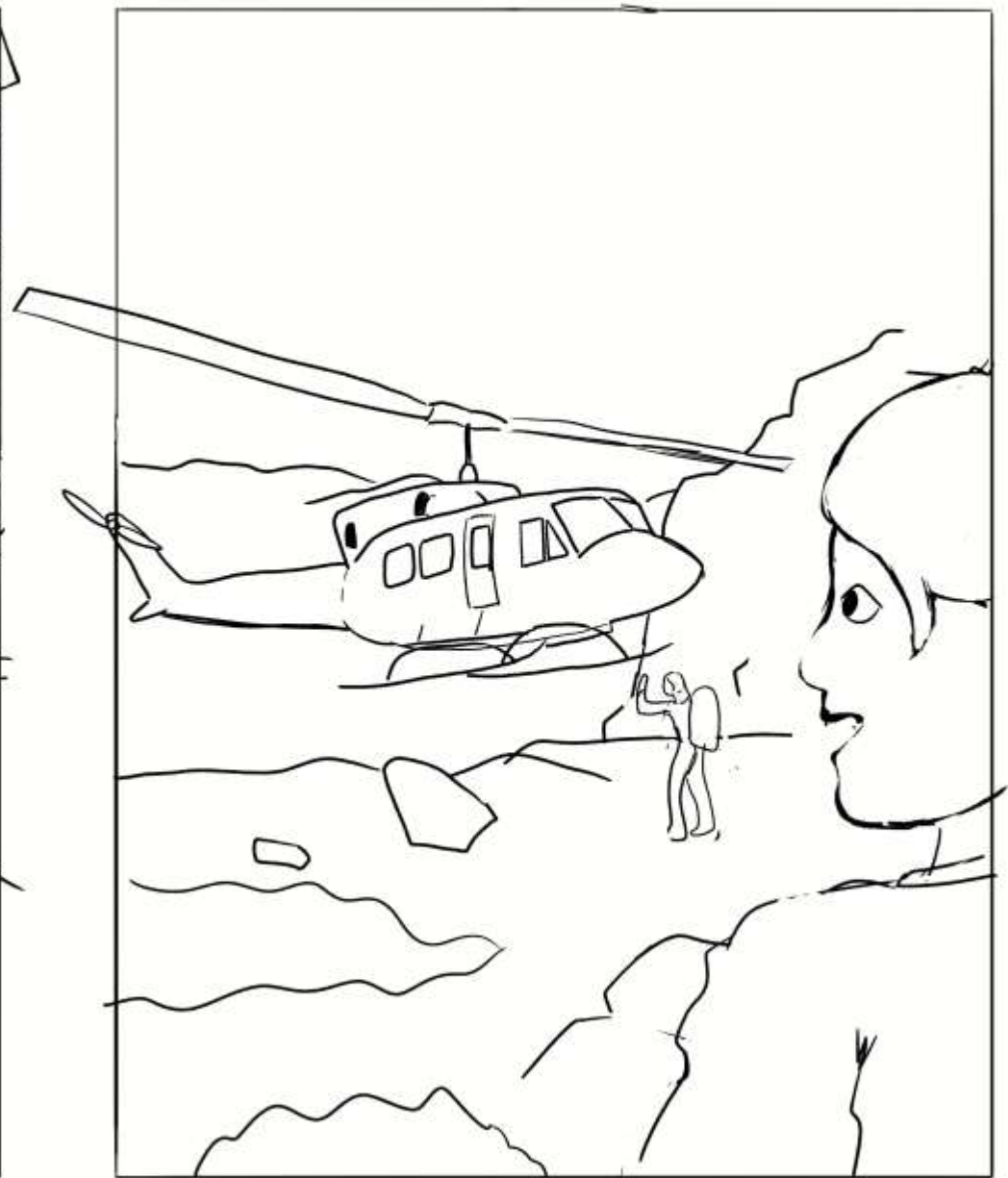


Satellites in Space Help Us Live a Better Life on Earth!

- Predicting the Weather
- Measuring Climate Change
- Controlling Pollution
- Protecting Wildlife and Natural Resources
- Detecting and Fighting Wildfires
- Growing Bountiful Crops
- Navigating our Roads
- Guiding Ships and Airplanes
- Bringing Movies and Music to our Homes
- Communicating with Each Other (includes amateur radio)
- Finding Lost People
- Explore our Planet's Past







Exploring the Secrets of Space

Pages 4-5



1.0 INTRODUCTION

In beginning this paper, it is worth noting that the author has recently heard from colleagues, several comments, delivered via social media, which suggest that our thesis in the above abstract is flawed and the simple fact that the spacecraft we are reporting about here, AMSAT-OSCAR-7, may be older than the two JPL Voyager spacecraft is not relevant. AO-7 wasn't a real spacecraft like the Voyagers are. Some would use the term, "of dissimilar ethic" to put it another way. But, hold that thought! We'll get back to it!

Well, if we were to keep on this track, it would put us off to a bad start. Perhaps we shouldn't compare apples and oranges. What we'd like to do in this paper is tell you a long story about a well-loved piece of hardware, which was created by a group of enthusiastic space-loving young engineers looking for the opportunity to do something real in space. They came from many countries and backgrounds and for four years they worked together to create this 29 Kg object. They didn't have a lot of money. But, they had enough money to buy the essential items that couldn't be begged, borrowed or stolen. This is an account of an old small satellite, which defied the odds.

There would be little argument that the satellite was a SmallSat. It weighed less than 50 Kg and was launched as a secondary payload. This spacecraft, in its on-orbit performance not only did everything it's designers asked it to do, it proceeded to outlive the other two spacecraft that were launched with it (INTASAT and NOAA-4). AMSAT, the organization who developed the AO-7 mission, didn't have a lot of money so, a lot of hardware was borrowed from NASA laboratories and other government labs. Such laboratories and other hiding places had components left over from earlier missions. Our team never got much pushback from NASA or DoD employees, when we'd argued that putting such components back in space was a better

place for them than the government excess property list. It can be noted that not every person who made us such a loan believed we would be successful in getting the hardware launched. The fact of the matter is, most of hardware worth launching – did get launched by us. It also didn't hurt that we were technologically eager, enthusiastic, young engineers that wanted to know absolutely everything about the device being requested of the donor. So, now, 50 years on, our secret is out. It turns out, and it is a pretty universal human trait: people admire other young people that want to do good thing, especially if it happens to be with the hardware a particular engineer or technician designed themselves but, never got to fly.

1.1 Lucky AO-7

There are two sets of components, which fall into this category; they've made history because they did fly on AMSAT-OSCAR-7. Let's explain this.

1) One very exciting program that flew from NASA/GSFC was called Radio Astronomy Explorer (2). (RAE-2). This satellite did radio astronomy measurements from around the moon. This spacecraft used a standard NiCd battery design of the day, employing standard 6 AH cells. However, our understanding back then, these particular cells were procured from a local vendor and underwent different assembly procedures than were used by a vendor like Eagle-Pitcher (a vendor we were very familiar with). This battery is the star of our show for the story we're telling. The particular battery pack we were given was the engineering-test battery for the RAE-2 program. It had accumulated many hours working under load in the RAE-B ("B" before launch) functional and environmental test program, before it was removed and retired. This battery, unfortunately (but, also very fortunately – as we'll explain) became the primary battery for AO-7. NiCd battery cells, as they accumulate more cycles, begin to increase their series resistance. This causes the voltages of each cell in the battery pack to begin to sag under load. This behavior gets worse with the increasing number of duty cycles,

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